R3BRoot: a FAIRRoot-based development for the analysis and simulation of the R^{3}B experiment*

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R3BRoot is the simulation tool for the R3B and LAND/ALADIN setup [1]. It inherits most of the behaviour from the FAIRRoot framework [2], a ROOT-based development for the simulation and data analysis developed at GSI for the analysis of the future FAIR experiments.

The framework delivers base classes which enable the users to construct their detectors and derive simulation and analysis tasks in a simple way. It also supplies some general functionality like track visualization, database support, event structure and persistency tools (binary ROOT files), and the full mathematical, histogramming and advance analysis machinery contained in the ROOT classes. As a data-analysis tool, R3BRoot allows an event-by-event based analysis, from the unpacking and basic calibration to the final processing of the combined physics observables, following a set of succesive tasks, ruled by user-friendly macros. As a simulation tool, R3BRoot supports Geant3 and Geant4 transport engines, interfacing with their geometry constructors.

R3BRoot features a complete description of the LAND/ALADIN setup detectors, including their basic response to the particle interaction and digitization and event generators for several reactions of interest, including QFS, spectroscopic decays, … The ALADIN magnet field map is included (as an interpolated value based on field-map measurements), as well as the design value of the future GLAD magnet. The user can switch between the two arrangements by a simple setup selection in the configuration macros, mixing of any kind of non-overlaping detectors.

Calibration and digitization parameters, geometry elements of detectors and other parameters are stored in a runtime database supporting different input/output methods, including Ascii, ROOT binary format and several available databases using SQL lenguage. The runtime database supports per-run parameter evolution (different level of analysis, evolution in the detector definition, …) in a multidimensional scheme. Different parameter tables has been already implemented for evaluation.

R3BRoot has been intensely employed during the design phase of the main R3B detectors, and along the evaluation of their characteristics performed during the redaction of the corresponding TDRs of the CALIFA Barrel [3] and NeuLAND [4], recently approved. Advanced reconstruction algorithms have been developed from both detectors, using this environment.

An important endeavor to expand the R3BRoot functionality to the analysis of the present and future data is ongoing, allowing the realization of the analysis and simulation under the same platform; the benefits of these aproach include the evaluation of the geometrical efficiencies and other systematical uncertainties under the same platform in a coherent process.

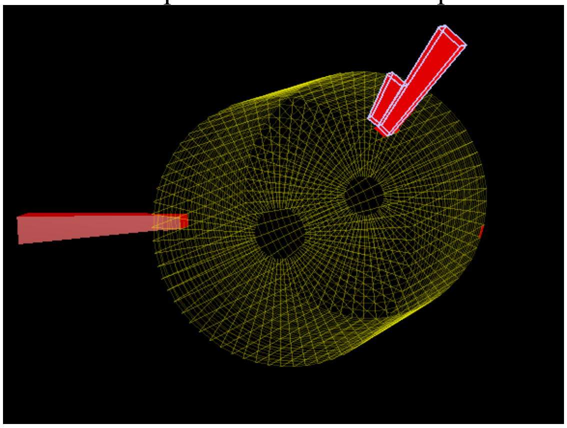

Figure 1: EVE event and hit finder outcome visualization for the CALIFA BARREL.

References

[1] FAIRRoot, http://fairroot.gsi.de/
[2] R3BRoot instalation instructions and repository, http://fairroot.gsi.de/?q=node/11
[3] D. Cortina *et al.*, "The R3B CALIFA Barrel design" in this annual report.
[4] D. Boretzky *et al.*, "NeuLAND@R3B - A Progress Report" in this annual report.